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ABSTRACT

Topics in this paper include: sources of computer programs, public domain software, copyright violations, purposes of computers in classrooms (drill/practice and interactive learning), computer assisted instruction, flow charts, and computer clubs (such as App-le-kations in Charlotte, North Carolina). A complete listing of two computer programs (in Applesoft Basic) are also listed, "LIGHT BULB" and "BLASTOFF." The first program sets up an introductory graphic of a light bulb and Duke Power Plant, gets the user's name and provides feedback, erases Duke Power identifier and leaves light bulb, causes the light to flash on/off, asks questions of the user, and uses a flashing subroutine if the answer is correct and a noise subroutine if the answer is incorrect. The second program, written as a reward program to provide motivation, clears the screen and produces a countdown with sound from 10-0, provides a blastoff sound, draws a rocket and flame, moves the rocket up the screen, and clears with screen printing an "A-OK" message. (Author/JN)

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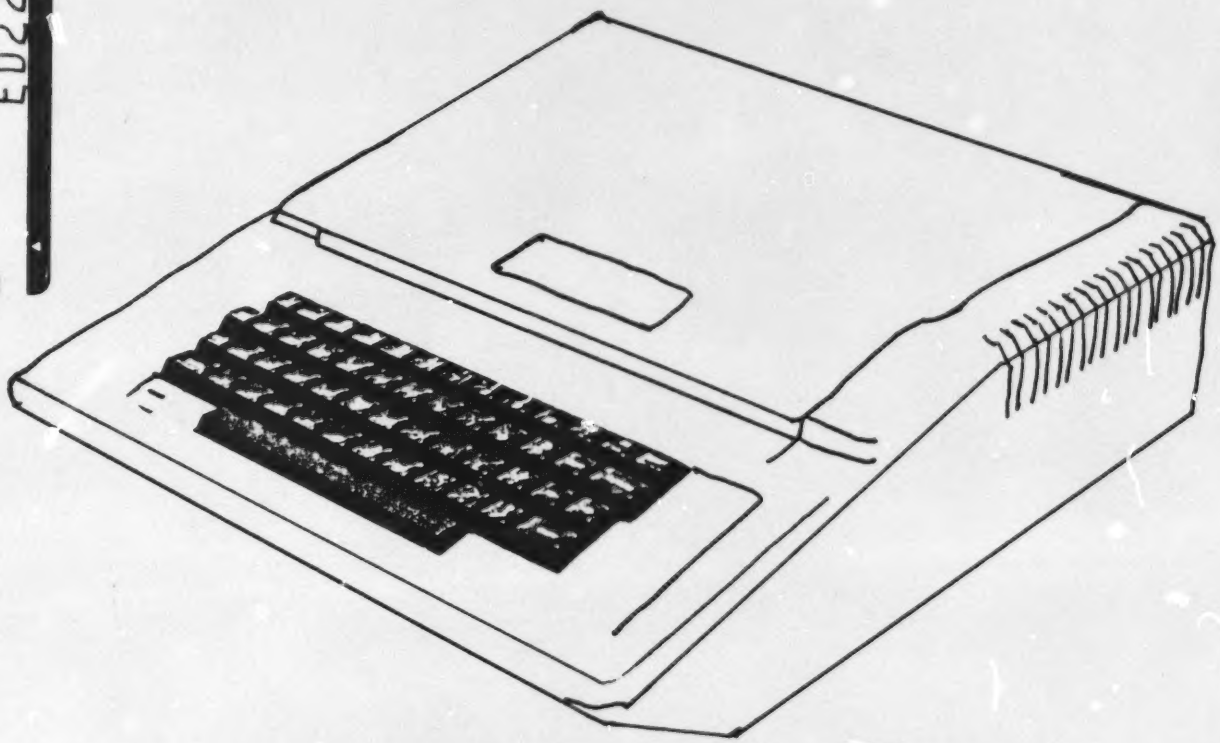
TYING INTO COMPUTERS



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INTRODUCTION

When I was asked to prepare a talk for the ENERGY, ENVIRONMENT, AND ECONOMICS TEACHER WORKSHOP, I decided to tackle a problem in which many teachers are interested. This problem is in the area of computer assisted instruction (CAI). Since this workshop dealt with the area of energy what better program to write than one dealing with energy and aptly named LIGHT BULB. The program listing for LIGHT BULB is included as part of this package. One of the important things that is also included as part of the package is a reward program that is called BLASTOFF; the program listing for this program also appears in the package.

All programs and listings are for the APPLE II + microcomputer. Since there are many graphic commands within the program it would be difficult for conversion to other microcomputer applications. The listing of the program lines and their actions will facilitate this for anyone who desires to attempt the conversion.

PROGRAM ACTIONS

Light Bulb program:

10-65 set up the introductory graphic of the light bulb and Duke Power Company.

70-73 get the name of the user and provide feedback

79-85 erases the Duke Power identifier and leaves the light bulb

89-92 directs the program into the subroutines that cause the bulb to flash on and off

106-499 asks the questions of the user and sends the program into the flashing subroutines if the answer is correct and to the noise routine if the answer is incorrect

500-799 the flash routines

800-850 the reward routine if the student gets 5 of 5 questions correct; this routine loads another program from disc

900-999 provides the noise subroutine if there is an incorrect answer

Blastoff program:

1-310 clears the screen and produces a countdown with sound from 10-0

315 provides the blastoff sound

319-430 draws the rocket and flame

440-460 moves the rocket up the screen

505-530 clears screen and prints the a-ok message

It is hoped that the users of this package will not quit with the sample program listed. In the LIGHT BULB program there are a number of variations that would prove of benefit to the students who have access to microcomputers in the classroom. Many other questions can be added to the program with the idea of preparing a more complete lesson. The demo provided is just that a demonstration of how the technology can be used.

FUTURE

The most promising modification to this program would come from adding teaching subroutines to provide further learning should an incorrect response be given. The limit in this area would be the desire of the teacher to implement the additional subroutines into the program.

end

Ladies and Gentlemen, today I am going to be demonstrating one way that computers can be made to teach energy concepts, or at least to help you teach energy concepts.

What is a computer? A computer is nothing more or less than a machine that can understand specially-coded instructions which are provided to it by a programmer. Can you be a programmer? Will you want to be a programmer? I don't know. With the amount of educational software available today, there is probably no need for any of you to ever have to program a computer to find a program that can be used to help you teach your students whatever subject you desire.

There are many sources of computer programs, both commercial and private, if you choose to go that route. The cost for a computer program varies with the complexity of the program. The cost may be several hundreds of dollars, but more typically is in the range of $15 - $30. A number of computer user groups have been formed and they have written a great number of programs that are available in the public domain. What this means is that they are available for anyone's use without any copyright violations. As teachers, you should be aware that many computer programming companies are prosecuting violators of their copyrights. It is not permissible, I repeat not permissible, to buy one program and copy it for the six different fifth grade classes who may be wanting to use it, unless a specific licensing agreement has been obtained from the computer company. Several companies have offered rewards up to $10,000 for information leading to the arrest and conviction of persons violating their copyrights on programs. So I would point out to you that this is a very serious thing. I have been a teacher and I have been known to copy copyrighted written material. Book publishers in the past have looked sort of askance at this -- software publishers do not. So a word to the wise is do not copy copyrighted materials.

But back to the public domain software. As I mentioned, a large number of programs are available in the public domain and can be copied. In other words, there is no copyright violation. A number of cities in North and South Carolina have formed computer user groups and these computer user groups in many cases work closely with the schools in their areas. If the club doesn't then the individual users or individual members do. The club here in Charlotte

is called App-le-kations. App-le-kations is devoted to the Apple Computers only. The programs that I will be demonstrating today are designed for the Apple. Similar users groups exist for other computers and you simply have to get in contact with your local computer store to find out what clubs are available for that particular computer.

The programs that I am going to be demonstrating today are public domain programs. One of them came to us from Apple Computer Company itself - the "Energy Hangman" that I have modified slightly - the others are programs that I have either written completely or have taken pieces of other public domain software programs. If any of you have Apple computers and would like copies of the programs that I am going to be using, you can get in touch with either Sondra or Joe and they can pass that on to me. Sondra will have some information to share with you about a computer program service that educational services is getting ready to start.

Computers can be used in the classroom for two basic purposes. One of these is for drill and practice to emphasize to the student the importance of a particular concept by a continuous repetition of those concepts. This is the old rote learning, that I'm sure all of you in your educational classes learned about. The computer is very good at this kind of process in that it does make use of a video screen scmetimes called a VDT (video display terminal).

Students are used to watching TV, and the computer is an extension of that TV watching, with the addition of the interactive nature of having to type something in on a keyboard. If there are enough computer terminals in the room, you can put either the slower students or the faster students learning, while you work with the rest of the class on a particularly difficult or simple concept depending on the point of view.

But rote learning is probably not the best use for the computer. While practice is very important, the computer can also provide an interactive learning tool. One of the games that I am going to be demonstrating today, which I have simply titled "Lightbulb" will show this kind of learning experience. Because I was writing this in a fairly short period of time, and because I have just gotten back from a training session in New York, and before that from vacation, the program is not very involved or complicated. It does, however, illustrate the point that I am trying to make and that is the computer can, based on Johnny's answer, provide various follow up conceptual knowledge in much the same way that you do in interactive questioning with Johnny.

Using this kind of program is called CAI, standing for Computer Assisted Instruction. CAI has been around for a number of years and a number of states have bought in to the idea of the utilization of computers for classroom learning. The state that has done the most in terms of promoting computer assisted instruction, on a state-wide basis, is Minnesota. Minnesota has established a consortium which works to provide all the teachers in Minnesota with programming materials. The consortium also sells developed programs at a fairly low price to educators outside the state of Minnesota. California also has done a fairly respectable job in terms of getting computers into the schools and utilizing them in the regular classroom routine.

North and South Carolina has been comparatively slow in moving toward computer-assisted instruction. Charlotte-Mecklenburg has been one of the leaders in the development of standards for a school system to follow in the purchase and evaluation of hardware and software. There are workshops going on this summer here in Charlotte to help teachers and administrators evaluate various pieces of equipment and various programs.

Computer programmers utilize something they refer to as flow charts. All a flow chart is for those of you who are not familiar is simply a step-by-step progression of how the program works with any particular choices that may be taken from a particular point. What I would like to do is to utilize flow charts for two of the programs; "Energy Hangman" and the other "Lightbulb" to show you what can be done with the straight rote memory learning for which "Energy Hangman" is an example, and interactive learning, for which "Lightbulb" is an example. Copies of the flowcharts which I am using are included within the packet of information that you have been given.

In addition to the flowcharts, I am including a printed version of the electronic program. If you have computers other than Apple and you wish to utilize the program, it would be necessary for you to type in the lines from the program listing. This program listing is sometimes a source code. I cannot guarantee if you type in the source code that your particular computer will be able to understand it. All computers, unfortunately, do not speak exactly the same language. Some of the syntax is the same -- but other of the commands are different. And if you are going to utilize this or any other program written for an Apple on a machine other than Apple, it will be necessary for you to make the necessary syntactical changes within the program.

If you have Apples or are going to be using Apples in your classroom, both of these programs can be obtained in electronic code and if you will get in touch with Joe or Sondra we'll be happy to provide you with the program so that you may copy it on to your own material. It can be copied either on tape or on disc depending on what your particular machine is set up for.

What I am going to do now is to conduct a sample lesson the way it might be done. I will be using specific students selected from the audience at random to assist me in doing the sample lesson or in using the computer as a teaching tool. Those of you who have used television as a tool in your classroom are aware of the size limitations on TV sets. Computers do not solve that problem, if you are trying to use them for classroom instruction. Because you have the ability to control the TV set through the computer program, it is perhaps a little easier to maintain the attention of the students, particularly if you ask them to interact with the program.

```
]LIST

1  TEXT : HOME
10  REM  BLASTOFF DEMO MODIFIED F
    ROM TRS-80
110  HOME
210  FOR C = 10 TO 0 STEP  - 1
211  PRINT  TAB( C)
215  LET A$ = "": REM  CNTRL-G IN
     QUOTES
220  PRINT C
221  PRINT A$
230  FOR PAUSE = 1 TO 300: NEXT P
    AUSE
240  NEXT C
250  PRINT "BLASTOFF!!!"
260  FOR PAUSE = 1 TO 400: NEXT P
    AUSE
310  HOME
315 S =  - 16336: FOR B = 1 TO 90
    :SOUND =  PEEK (S) -  PEEK (
    S) +  PEEK (S): NEXT B
319  VTAB (20)
320  PRINT  TAB( 20)"*"
330  PRINT  TAB( 19)"#U#"
335  PRINT  TAB( 19)"#S#"
340  PRINT  TAB( 19)"#A#"
350  PRINT  TAB( 18)"#####"
370  PRINT  TAB( 17)"$$$$$$$"
380  FOR PAUSE = 1 TO 400: NEXT P
    AUSE
409  PRINT  TAB( 19): FLASH
410  PRINT  TAB( 19)"!!!": FOR PA
    USE = 1 TO 300: NEXT PAUSE
415  NORMAL
420  PRINT  TAB( 19)"!!!": FOR PA
    USE = 1 TO 200: NEXT PAUSE
430  PRINT  TAB( 19)"!!!": FOR PA
    USE = 1 TO 100: NEXT PAUSE
440  FOR K = 1 TO 16
450  PRINT : FOR PAUSE = 1 TO 100
    : NEXT PAUSE
460  NEXT K
505  INVERSE
510  HOME
520  PRINT "ALL SYSTEMS ARE GO. E
    VERYTHING IS A-OK!"
525  NORMAL
530  END
```

```
10  TEXT : HOME : GR
15  REM  DUKE
16  COLOR= 2
20  VLIN 2,7 AT 3: VLIN 10,13 AT
     3: VLIN 21,23 AT 3: VLIN 18,
     19 AT 3: VLIN 5,7 AT 1: VLIN
     10,13 AT 1: VLIN 15,19 AT 1:
      VLIN 21,25 AT 1: HLIN 1,3 AT
     25: PLOT 2,23
25  PLOT 2,21: PLOT 2,17: PLOT 2,
     13: PLOT 2,7: PLOT 2,5: PLOT
     3,16
30  REM POWER
31  VLIN 2,7 AT 31: VLIN 9,13 AT
     31: VLIN 15,19 AT 31: VLIN 2
     1,25 AT 31: VLIN 27,31 AT 31
     : VLIN 2,4 AT 33: VLIN 9,13 AT
     33: VLIN 15,19 AT 35: VLIN 2
     1,23 AT 33
32  VLIN 16,17 AT 33: HLIN 31,33 AT
     25: PLOT 32,28: PLOT 33,27: PLOT
     32,23: PLOT 32,21: PLOT 32,1
     8: PLOT 34,18: PLOT 32,13: PLOT
     32,9: PLOT 32,4
33  PLOT 32,2
35  REM  BULB ROUTINE
40  COLOR= 13
41  HLIN 17,20 AT 2: HLIN 15,16 AT
     3: HLIN 16,20 AT 16: VLIN 8,
     11 AT 11: VLIN 6,7 AT 12: VLIN
     11,12 AT 12: VLIN 11,12 AT 2
     4: VLIN 8,11 AT 25: VLIN 6,7
      AT 24: PLOT 21,3: PLOT 22,4
     : PLOT 23,5: PLOT 23,13
42  PLOT 22,14: PLOT 21,15: PLOT
     15,15: PLOT 14,14: PLOT 13,1
     3: PLOT 13,5: PLOT 14,4
50  REM BASE
55  COLOR= 8
57  HLIN 16,20 AT 17: HLIN 16,20 AT
     19: HLIN 16,20 AT 21
60  COLOR= 15
65  HLIN 17,19 AT 23
70  FLASH : PRINT "WHAT IS YOUR F
     IRST NAME ?": NORMAL : INPUT
     NA$
71  INVERSE : PRINT : PRINT : PRINT

72  PRINT "WELCOME ";NA$;" TO LIG
     HT BULB !!"
73  NORMAL
79  COLOR= 0
80  VLIN 2,7 AT 3: VLIN 10,13 AT
     3: VLIN 21,23 AT 3: VLIN 18,
     19 AT 3: VLIN 5,7 AT 1: VLIN
     10,13 AT 1: VLIN 15,19 AT 1:
      VLIN 21,25 AT 1: HLIN 1,3 AT
     25: PLOT 2,23
```

```
81  PLOT 2,21: PLOT 2,17: PLOT 2,
     13: PLOT 2,7: PLOT 2,5: PLOT
     3,16
82  VLIN 2,7 AT 31: VLIN 9,13 AT
     31: VLIN 15,19 AT 31: VLIN 2
     1,25 AT 31: VLIN 27,31 AT 31
     : VLIN 2,4 AT 33: VLIN 9,13 AT
     33: VLIN 15,19 AT 35: VLIN 2
     1,23 AT 33
83  VLIN 16,17 AT 33: HLIN 31,33 AT
     25: PLOT 32,28: PLOT 33,27: PLOT
     32,23: PLOT 32,21: PLOT 32,1
     8: PLOT 23,18: PLOT 32,13: PLOT
     32,9: PLOT 32,4
84  PLOT 32,2
85  PLOT 34,18
89  FOR I = 1 TO 30
90  GOSUB 500: GOSUB 599
92  NEXT I
106  PRINT : PRINT : PRINT : PRINT

110  PRINT "WHAT CHARGE DOES AN O
     BJECT WITH MORE ": PRINT "EL
     ECTRONS THAN PROTONS HAVE ?"
     : INPUT AN$
111  IF AN$ = "NEGATIVE" THEN  GOSUB
     700
112  IF AN$ <  > "NEGATIVE" THEN
      GOSUB 900: GOTO 106
119  PRINT
120  PRINT "THE TYPE CURRENT THAT
      A BATTERY PRODUCES IS --.":
      INPUT AN$: IF AN$ = "DC" THEN
      GOSUB 700
121  IF AN$ <  > "DC" THEN  GOSUB
     900: GOTO 119
129  PRINT
130  PRINT "MATERIAL WHICH RESIST
     S THE FLOW OF ELEC-";: PRINT
     "TRICITY IS CALLED ---------
     .": INPUT AN$: IF AN$ = "INS
     ULATOR" THEN  GOSUB 700
131  IF AN$ <  > "INSULATOR" THEN
      GOSUB 900: GOTO 129
139  PRINT
140  PRINT "MATERIAL THROUGH WHIC
     H ELECTRONS FLOW": PRINT "EA
     SILY IS CALLED ---------.": INPUT
     AN$: IF AN$ = "CONDUCTOR" THEN
      GOSUB 700
141  IF AN$ <  > "CONDUCTOR" THEN
      GOSUB 900: GOTO 139
149  PRINT
150  PRINT "THE PATH ELECTRICITY
     TAKES IS CALLED A ": PRINT "
     -------.": INPUT AN$: IF AN$
      = "CIRCUIT" THEN  GOSUB 700

151  IF AN$ <  > "CIRCUIT" THEN  GOSUB
     900: GOTO 149:
159  PRINT
499  END
500  COLOR= 13
```

```
510  HLIN 17,20 AT 3: HLIN 15,21 AT
     4: HLIN 14,22 AT 5: HLIN 13,
     23 AT 6: HLIN 13,23 AT 7: HLIN
     12,24 AT 8: HLIN 12,24 AT 9:
      HLIN 12,24 AT 10: HLIN 13,2
     3 AT 11
515  HLIN 13,23 AT 12: HLIN 14,22
      AT 13: HLIN 15,21 AT 14: HLIN
     16,20 AT 15
516  PLOT 13,13
550  RETURN
599  COLOR= 0
610  HLIN 17,20 AT 3: HLIN 15,21 AT
     4: HLIN 14,22 AT 5: HLIN 13,
     23 AT 6: HLIN 13,23 AT 7: HLIN
     12,24 AT 8: HLIN 12,24 AT 9:
      HLIN 12,24 AT 10: HLIN 13,2
     3 AT 11
615  HLIN 13,23 AT 12: HLIN 14,22
      AT 13: HLIN 15,21 AT 14: HLIN
     16,20 AT 15
690  RETURN
700  FOR I = 1 TO 10: GOSUB 500: GOSUB
     599: NEXT I
701  LET A = A + 1
750  IF A = 5 THEN  GOSUB 800
799  RETURN
800  REM  REWARD ROUTINE
805  COLOR= 13
810  HLIN 17,20 AT 3: HLIN 15,21 AT
     4: HLIN 14,22 AT 5: HLIN 13,
     23 AT 6: HLIN 13,23 AT 7: HLIN
     12,24 AT 8: HLIN 12,24 AT 9:
      HLIN 12,24 AT 10: HLIN 13,2
     3 AT 11
815  HLIN 13,23 AT 12: HLIN 14,22
      AT 13: HLIN 15,21 AT 14: HLIN
     16,20 AT 15
825  PLOT 13,13
850  PRINT "RUN BLASTOFF"
900  REM  ERROR NOISE ROUTINE
901 S =  - 16336
902  FOR I = 1 TO 25
905 NOISE =  PEEK (S) -  PEEK (S)
     -  PEEK (S) -  PEEK (S) -  PEEK
    (S) -  PEEK (S) -  PEEK (S) -
     PEEK (S) +  PEEK (S)
910 NOISE =  PEEK (S) +  PEEK (S)
     +  PEEK (S) +  PEEK (S) +  PEEK
    (S) +  PEEK (S) +  PEEK (S) +
     PEEK (S) -  PEEK (S)
916  NEXT I
999  RETURN
```